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The Environmental Effects of Economic Growth of China and India its impact on Brazil, Russia, India, China, and South Africa (BRICS)

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Introduction:

The BRICS countries (Brazil, Russia, India, China and South Africa) are significant players in the contemporary global political economy. The environmental effects that the BRICS countries cause are extremely important, particularly as it impacts global climate change. The BRICS states are all developing industrialized countries, but are known for their fast-growing economies and influence on regional and global importation and exportation affairs. The BRICS have achieved significant gains in both an economic and a political sense. Collectively, the BRICS account for more than 40% of the global population and nearly 30% of the landmass on Earth. The group constituted a share of about 25% of the world gross domestic product (GDP). This is expected to rise significantly in the near future (Wilkin & Papa 2013).

Due to this rapid economic growth, environmental issues have also risen in these countries, which in turn affect us all. The BRICS pact has accounted for over one third of global carbon emissions, not counting the emissions caused by deforestation and other environmentally unfriendly land use. In Brazil, unsustainable land use practices produced 27% of total carbon emission, with deforestation lowering the country's stock of stored carbon by 6 billion metric tons. The rapid rise of the BRICS economies has been driven by an extremely fast pace of industrialization and unsustainable practices (Lintao 2017).

My concern with the BRICS is the environmental and health issues within the affected communities from the pollution of industrialization in these countries. What are the environmental effects of economic globalization on India and China, specifically climate change? I will be developing my capstone around the affects of the global and local environment due to these conditions, specifically looking into China and India. I hope to provide a solution to these problems in order to reduce climate change and global warming, which affects everyone that lives on this planet.

Literature Review:

The BRICS have been closely watched over the past few years because of their exponential growth in economies. They are expected to be one of the biggest global economies within the next couple of decades. The BRICS are widely influential and inspirational for other developing countries, which is why it is important that they use sustainable methods to grow their economies.

The BRICs are being watched by everyone, therefore what policies they stand by are important. They are used as a guideline for other developing countries that aspire to grow their own economy. Since the BRIC's population is approximately 3 billion people, their global impact on emissions is significant. If they are able to obtain sustainable development, other developing countries may be able to join their economic success without sacrificing the health of the planet and oppressing laborers (Wheeland 2015).

China is known for its human right issues, air, soil and water pollution, and etc. In order to rapidly increase their economic status, they have abandoned basic human rights through the corruption of low wages and mass production. In January of 2015, China changed their Environmental Protection Law. Their new law allows local governments to fine polluters on a daily basis up until the problem is solved, which eliminates a cap on pollution fines. The new law also gives Chinese NGOs the power to sue polluters, which gives activists more power against the "war on pollution." Although there have been laws in place to protect the environment, there is a lack of implementation in China. In 1995, China's central bank required all financial institutions to prioritize protecting the environment when deciding which projects to help fund. According to 2012 reports, only 12% of financial institutions have seriously adopted

this requirement and 18% have not shown any evidence of implementing the 1995 policy (Wheeland 2015).

India's pollution and population is quickly rising to equal China's, but with one third of the amount of land. India is suffering from the lack of resources for its population, such as water and food. A study from the World Bank in 2014 found that air and water pollution, deforestation and natural disasters cost India $80 billion dollars per year, with over 50% of that cost contributing towards air pollution. The air pollution in India is affecting the process of photosynthesis for plants, which have cut crop yields in half. While pollution is a huge problem in India, so is poverty. In 2012, only 36% of India's population had access to "improved sanitation." Pollution and poverty and intertwined consequences for the Indian population. As an effort for sustainable development, in 2014 India has launched a 5 year plan called Clean India Mission. It's purpose is to stop open defecation, provide more access to improved sanitation, and to clean up the Ganges River. Several corporations have joined Clean India Mission, and has invested to educating young girls and adopting communities for clean up (Wheeland 2015).

It would be ideal that all BRICS implement environmental policies in order to preserve the natural habitats of their local ecosystems. The pollution of using factories and nonrenewable resources to advance their economies will be detrimental to the health of the earth.

Air pollution is the leading cause of premature death. In 2012, 4.3 million deaths were traceable to air pollution. There is a direct relation between air pollution and climate change as well as the wellbeing and health of humans. CO_2 emissions are the main contributors to climate change and also air pollution. Air pollutants are are harmful to our health as well as our surrounding ecosystems. Short-lived climate-forcing pollutants (SLCPs) includes methane, black carbon, ground-level ozone, and sulfate aerosols. Although CO_2 remains in the atmosphere for

hundreds of years, SLCPs have shorter atmospheric lifetimes comparatively. SLCPs can stay in the atmosphere between hours to weeks, which is less harmful to our environment than carbon dioxide (Institute for Advanced Sustainability Studies n.d.).

Many economists have predicted within the next few decades that the BRICS economies will have revolutionary growth. This extreme growth may cause a negative impact on the environment since they will be extracting high amounts of natural resources to fuel their economic expansion. One of their biggest hurdles would be to maintain or improve the quality of the environment. However, the Environmental Kuznets Curve (EKC) Hypothesis believes that there is "an inverted U shape relationship between income and emission per capita, this suggests that the BRICS economies do not need to bother too much about environmental quality while growing because growth would eventually take care of the environment once a certain level of per capita income is achieved" (Chakravarty & Mandal 2016). This hypothesis is based on the belief that the BRICS will adopt or create more efficient processes with renewable and viable resources when they obtain enough revenue.

This hypothesis is only valid if the BRICS decide to be more environmentally friendly with more expensive, eco-friendly procedures. The mentality of most corporations is to try to achieve maximum profit from their products. In order to to achieve maximum profit, most existing systems use nonrenewable resources. But to allow for environment preservation and safety, extra policies and changes should be made right now. They should not wait until they "earn a certain level of per capita income" (Chakravarty & Mandal 2016) to help maintain and make a better environment.

The urbanization of the BRICS can also lead to increasingly more ecological, air and water pollution. Since there a more available jobs in urbanized areas than in rural, people tend to

migrate to those areas for more opportunities. A study by J.Y. Zhou suggests that ignoring urbanization will result to the mismatching of urbanization and industrialization. It has also been predicted that rapid urban expansion is a significant factor in climate change. These environmental issues will become more serious if they do not try sustainable practices regarding urbanization. A study done by R. Marten found that the BRICS countries have tried to improve health conditions within the recent years. They examined the link between electricity consumption, economic growth and carbon emissions in the BRICS from 1990-2010 and determined that there is room for improvements to move towards a low carbon economy (Shen, L., Shuai, C., Jiao, L., et. al 2017).

Industrialization and urbanization has always gone hand and hand throughout history. It is important to distinguish what the problems are with each aspect of industrialization and urbanization so that we can reduce the amount of impact we are making to the environment. Although, Carbon emissions coincide with both issues since factories and congested traffic cause an excessive amount of pollution. Electricity and water consumption can indicate the growth of population as well as the usage within factories. That being said, it can be difficult to distinguish the differences between industrialization and urbanization.

As stated earlier, China is notorious for being a major polluter. Its economic growth in the past three decades has been the fastest among major nations, which is the main factor in why China has extensive air pollution. Of the twenty cities with the worst air pollution worldwide, 16 are located in China, including Beijing. Due to this extensive air pollution, China's Environmental Sustainability Index is ranked near the bottom among countries worldwide. The causes of Beijing's widespread air pollution can be attributed to a number of factors: an enormous economic boom, a surge in the number of motorized vehicles, population growth,

output from manufacturing, and natural reasons which include the city's surrounding topography and seasonal weather. China has also experienced major economic growth with a drastic rise in GDP. This increase in wealth can be correlated with an increase in pollution (Viola, E., & Basso, L. 2016).

New Delhi, India's most populous city as well as its capital, is also heavily polluted. The population of this one city is over 10 million. New Delhi has significantly increased the number of motor vehicles on its streets in the past decade. There have been records of increasing amount of pollution-related deaths within the city. More people have been sent to the emergency room with increased health problems due to the air quality. These health issues include, asthma, chronic obstructive airway disease and acute coronary events (Pande, J., Bhatta, N., Biswas, D., et. al 2002).

The amount of carbon dioxide emissions by the lag of the emissions and from the Gross Domestic Product for the BRICS from 1980-2011. They categorized the countries into 2 groups. Group 1 consists of Brazil and Russia, which have been identified as the main cause of carbon dioxide emissions during the timeline compared to their annual Gross Domestic Product. Group 2 consists of China, India and South Africa; the findings of these countries do not depend on the GDP, the findings only state the emission of carbon dioxide during the given timeline. The authors state that their study examines the BRICS on a case-by-case basis in order to identify the main contribution to the degradation of the environment and if it is affected by the growth of the economic activities (Azevedo, V. G., Sartori, S., & Campos, L. M. 2018).

A study done by the Intergovernmental Panel on Climate Change has shown that the concentration of CO_2 has increased dramatically within the past 100 years. 600-100 years ago, the concentration level of carbon dioxides was steadily between 175-300 ppmv (parts per million

by volume). Between the year 1990 and 2015, the ppmv increased from 355 to 405. It is projected that the atmospheric carbon dioxide concentration will increase to nearly 1,000 ppmv by 2100 if we do not change the way we live (Intergovernmental Panel on Climate Change 2014).

This comparison of GDP and how it relates to carbon emissions is important since it allows us to see how much pollution is being made compared to the amount of making the countries are making. This relates to the Environmental Kuznets Curve (EKC) Hypothesis, which believes that when the BRICS earn enough income, they will eventually help the environment through eco-friendly systems. How much money is enough to say that it's okay to spend money on the environment now?

Another study was done to track the resource footprints of biomass, fossil fuel, minerals and water within the BRIC countries (this article did not include South Africa) from 1995 to 2008. The article is titled Trends of natural resource footprints in the BRIC countries. The authors use a global, multi-regional input-output model based on the World Input-Output Database (WIOD) and extends their information using material extraction data. They compared the BRIC's resource footprints and consumption-based resource productivity. From the results of their data, it shows that one third of global resources were extracted to satisfy the consumption of the BRIC countries. But, the BRIC's overall consumption per capita footprint was still below the world average (Wu, R., Geng, Y., & Liu, W. 2017).

Even though the BRICS are using non renewable resources, they are not making as big of an impact to the environment as western, industrialized countries. They are still contributing to the inevitability of the extinction to fossil fuels and other non renewable resources.

One main contributor to climate change is the release of carbon emissions. The side effects include economic losses and ecological extinction. In the article, Room for improvement in low carbon economies of G7 and BRICS countries based on the analysis of energy efficiency and environmental Kuznets curves, the author, Ming Chang, provides suggestions to the BRICS in order to have low carbon economies. She measures room for improvements using new development analysis methods, which is the data envelopment analysis (DEA). It assess the environment and the energy performance of decision making units (DMUs) (Chang, M. 2015).

Chang also compared other western countries to the Kuznet hypothesis, which failed to complete the U-shape, instead it was inverted. This proves that these countries, that have been industrialized for hundreds of years, continue to depend on high carbon economies.

According to the article Public support for environmental organisations in BRIC countries, it remains debatable if environmental activism can be a function within economic development. The citizens of the BRIC countries have become more concerned with the environment and their increasing economies. However, action has not been taken place in order to preserve the environment. There are some institutional barriers and conflicting beliefs within the government. The Russian and Chinese economies have exponentially increased compared to Brazil and India. The main factor to this division is the type of governments that they have. Russia and China have authoritarian countries, therefore, activist have restrictions if they do not have authorization by their government.

There are various types of greenhouse gases (GHG) in the atmosphere causes extreme changes to our climate, some of which are irreversible. The average global temperature is expected to increase between 3.5 and 4 degrees celsius by 2100 if there are no changes in our consumption rate. Global decarbonization promotes decreasing GHGs so that our atmosphere does not worsen and eventually gets better. China is a huge contributor to GHGs since they are the most populated country on earth and holds the second largest economy. They are considered as a super-consumer of energy since energy is widely imported to China from other countries.

Between 1990 and 2012, the greenhouse gases in China has increased more than 230% (Viola, E., & Basso, L. 2016).

Russia is also known to be a contributor to climate change since they are considered to be a super-exporter of fossil fuels. Their revenue depends on the use of natural gases and other polluters; therefore, they would not benefit from renewable energy. Oddly enough, their production of global emissions have gone down by 50% between 1990 and 2012.

India comes into second, after China, for the world largest population. Their economy has grown much quicker than Russia and Brazil. They are starting to become a significant contributor to greenhouse gas emissions, but their per capita emission is still low. India is considered to be a high importer of energy. Their emissions have increased by 140% between

Table 1: Total GHG emissions (Mt CO2e)

	1990 including LULUCF	1990 excluding LULUCF	1990 % of world emissions with LULUCF	2012 including LULUCF	2012 excluding LULUCF	2012 % of world emissions with LULUCF	δ 1990-2012 including LULUCF	δ 1990-2012 excluding LULUCF
China	3,218.45	3,320.97	9.48%	10,684.29	10,975.50	22.44%	231.97%	230.49%
Russia	2,776.78	2,776.78	8.18%	2,254.47	2,322.22	4.73%	-18.81%	-16.37%
India	1,212.02	1,239.06	3.57%	2,887.08	3,013.77	6.06%	140.18%	143.23%
Brazil	1,606.59	565.09	4.73%	1,823.15	1,012.55	3.83%	13.48%	79.18%
World	33,937.21	30,423.75		47,598.55	44,815.54		40.25%	47.30%

Source: Authors' own elaboration, based on data from World Resources Institute, *CAIT – Climate Data Explorer* (database). <http://cait.wri.org/>. Accessed December 15, 2015.

1990 and 2012.

Brazil has released different types of greenhouse gas emissions known as land use, land use change, and forestry (LULUCF). Between 1990 and 2012, Brazil has lessened their LULUCF emissions, but have increased other emissions. Above is a table from the article that shows the total GHG emission in 1990 compared to 2012 from the BRIC countries and the World.

It is evident that the BRICS countries are huge contributors to pollution to our already polluted world. We should start developing new energy that is sustainable and profitable so that these countries and others can continue to grow.

In 2017, the BRICS have promised to engage with the Paris Agreement. The Paris Agreement builds on top of the Paris Convention. It calls for all nations to take on efforts to combat climate change, with extra support for developing countries. The agreement is aimed to strengthen the response against climate change by keeping the global temperature from rising, it's goal is to be 2 degrees Celsius above pre-industrial temperatures. The Paris Agreement also strives to reduce all types of pollution (The Paris Agreement 2017).

Theoretical Framework:

Ecological civilization is based on the harmony and coexistence of humans and the surrounding environment and everything that lives in the community. It's supposed to establish sustainability within the aspects of consumption and production. Ecological civilization promotes sustainable development as well as emphasizing the human consciousnesses and self-discipline to coexist with the natural environment. The core of ecological civilization is the respect between economic development and the ecological environment. This theory envelopes all ideas regarding ecological awareness, ecological legislation, and ecological behavior.

Ecological civilization derives from the an American doctrine titled "Human Ecology," which was published during the 1920s. This doctrine advocated for urban managers to create or adopt some ecological principles. There was a budding issue regarding the dangers of pesticides, which harmed the environment and humans. This issue raised awareness for other environment-harming procedures, the concept spread to the other western societies during the 1970s. The purpose of raising awareness was to change legislation and political views in order to place environment protection laws. So much damage has been done through the industrial civilization and we should be working towards a healthier environment. Roy Morrison, the author of

"Ecological Democracy" claims that income tax should be replaced with pollution tax therefore it would penalize heavy polluters, and would push them to use more eco-friendly procedures.

Methodology:

I have found, they use both qualitative and quantitative analysis of the environment within the BRICS countries.

In the article Dynamic sustainability performance during urbanization process between BRICS countries, their study measures the sustainable urbanization performance between the BRICS. They define two variables, which are urbanization sustainability (US) and urbanization rate (UR). These two factors follow each other since urbanization rate follows the amount of people migrating to certain areas, meanwhile urbanization sustainability measures if it is practical for those people to living there.

Meanwhile the article Room for improvement in low carbon economies of G7 and BRICS countries based on the analysis of energy efficiency and environmental Kuznets curves, bases their findings off the environmental Kuznet curve hypothesis. They conclude that the energy and environmental efficiency index is made to evaluate energy and environmental contribution through programming methods such as data envelopment analysis (DEA) models. It is a linear programming methodology that measures the efficiency of multiple decision-making units (DMUs) when the production process presents a structure of multiple inputs and outputs. Their study includes outputs that measure the overall efficiency of establishing practice frontiers of desirable and undesirable outputs in order to assess their procedures. Their method estimates and measures environmental efficiencies by their outputs so that they may connect any operational and environmental efficiencies to overall efficiency.

Findings:

The BRICS are willing to promote for environmental preservation, but have yet to implement a plan to do so. In June of last year, the BRICS have promised to help diminish air pollution in their respective countries. They had also sworn to implement the Paris Agreement and also urged developed countries to pass on technology to the countries in need in order to follow the Paris Agreement. The BRICS hold a huge role for pivoting and improving global environmental management because they own 23% of the world's GDP. The Kuznet Curve hypothesis applies to the BRICS countries. When their economies first started, they did not care about the environment as much. They only wanted to develop rapidly. As they are reaching their pinnacle of development, the BRICS start to care about the detrimental environmental issues that they have caused.

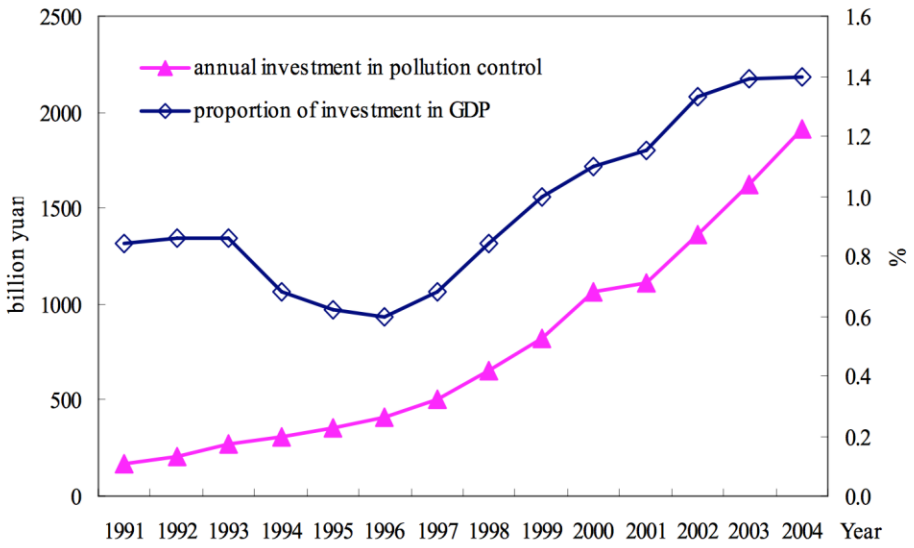

Fig. 1 Change in investment to environmental pollution treatment in China

Figure 1 depicts the amount of yuan, Chinese currency, spent on investments for GDP versus pollution control. It is obvious to see that the Chinese government has spent more on

economic advancement rather than the environment between 1991 and 2004. Although, it shows that there is a dramatic incline of yuan spent to control pollution levels between 1997 and 2004.

Carbon emissions is a huge issue that causes air pollution in the BRICS countries. It is expelled from every machine that does not use clean energy to run. China is known to be one of the biggest polluters in the world, especially with their large population and the amount of factories that are based in the country. It would take a long a time to reverse the effects that they have caused over the past few decades, maybe they are irreversible.

Surprisingly, China has tried to implement environment protection policies, but they have not really worked. As stated in the literature review, China's government financial institution created a policy in 1995 for all Chinese banks to prioritize any environment protection projects for immediate funding. The statistics showed that only 12% of banks took this policy into consideration by 2012. Enforcement for environmental policies and protection must be implemented. It is not enough to have it written in legal documents.

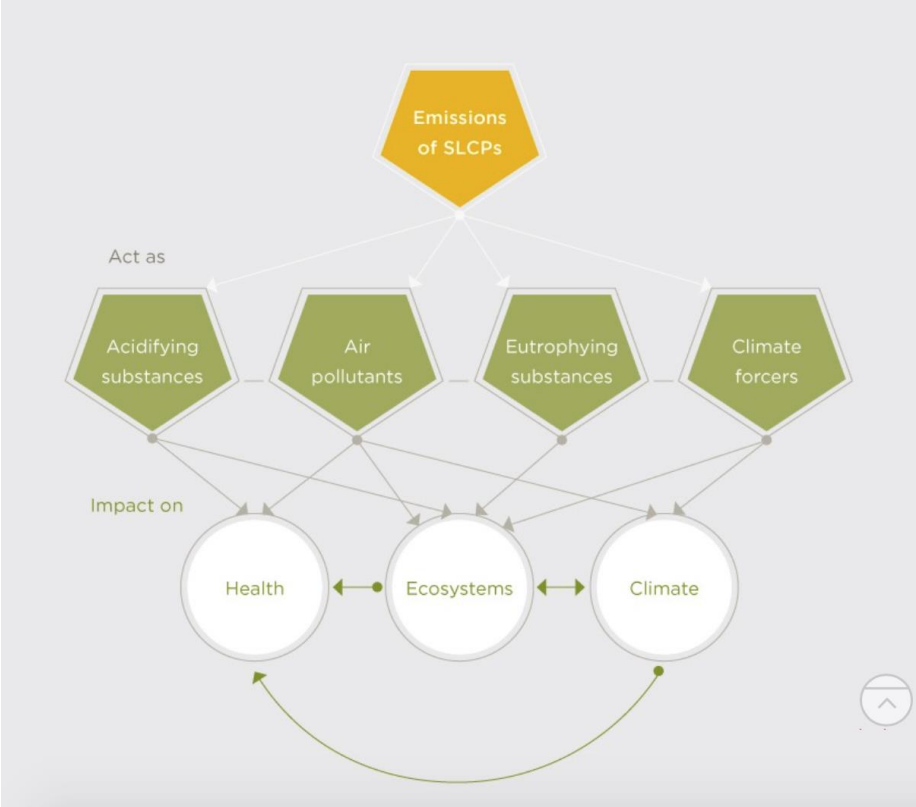

Fig 2. How Emissions of SLCPs effect Climate, Ecosystems, and Health

Figure 2 displays out how different types of pollutions interlinks and effects the climate, ecosystem and our health. This is a clear map to show how we should be careful a weary of what types of pollutants we create and dispose of into our atmosphere, it can affect our health which could lead to premature death.

As our cities become more urbanized and industrialized, the increase of pollutants is that result of that. Urbanized populous cities increase the amount of fossil fueled machinery that is created and used, which is in relation to the amount of pollutants.

Analysis:

As time goes on, the BRICS continue to grow in terms of their population, GDP, and even their economic disparities between their population. They need to plan for sustainable development in order to better the lives of their own citizens and the world's environment.

The BRICS have used unsustainable development in order to catch up with other developed countries in terms of GDP. Now that they have more money flowing into their economies, they have the means to create a more sustainable environment within their country, but how will they do it? This all lies under the Kuznet Curve hypothesis. The BRICS must aim to reach ecological civilization soon rather than later. There needs to be a balance with economic growth and the well being of the planet. Once they reach ecological civilization, they will be the role models for all developing countries trying to obtain a higher economic status.

Garrett Hardin brings in the idea of tragedy of the commons in a 1968 article. The idea is that if everyone consumes as much as they can only for their own profit or interest while not considering other people's needs, then there will be no more resources to consume for anyone. Everyone will be deprived of that resource since it was not sustainably used nor maintained, which in turn contributes to climate change because of the process of mass extraction.

Although, China and India are suffering from high carbon emissions and other pollutants, they cannot be solely blamed for their issues. The western world, such as the United States, have had some contribution to this growing dilemma. Their abuse of using cheap labor in order to provide low-cost products in order to stimulate their own economy is a main contributing factor. Many powerful companies establish their production factories within these rural areas in order to hire low income workers. In order to meet the demand as well as grow their own economy, China and India revert to using high-energy and high-carbon machines and methods in order to meet their needs. This in turn perpetuates the cycle of using unsustainable energy in order to maintain their economy.

Conclusion:

The BRICS need to come to consensus soon about stopping pollution from getting worse. Every year we see the effects of climate change and natural disasters because of the ever rising usage of nonrenewable resources. We are seeing the results of high levels of pollution due to human activity, yet little has been done. It is a great step forward that they are considering and willing to participate in programs to advocate for environmental protection and reduction of pollution, but more needs to be done.

It is possible that the western world may provide various types of aid in order to help China and India to advance to using more sustainable methods for production and to continue grow their economies. Pollution is a global issue and should be treated as such, the burden to get rid of pollution should not fall onto those that do not have the means to fully protecting the environment.

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